



July 23, 2009

TO: Steve Heare, Jeff Jollie and Ann Codrington
U.S. Environmental Protection Agency

FROM: Amy Mall and Sharon Buccino
Natural Resources Defense Council

RE: Hydraulic fracturing

Thank you again for meeting with us to discuss the issue of hydraulic fracturing regulation. We wanted to follow up with some additional information that was discussed during the meeting, including: (I) Specific incidents of concern; (II) State regulations and enforcement; and (III) Technical investigation recommendations.

First, some general points to consider:

- 1) The absence or presence of chemical additives in drinking water is not necessarily the sole determinant of contamination. Hydraulic fracturing can disturb the underground formation to the extent that it causes naturally occurring substances to enter the aquifer. Drinking water wells contaminated with naturally occurring substances, some of which may be toxic, are also evidence of contamination.
- 2) We are not only concerned with contamination of water wells. The Safe Drinking Water Act protects aquifers, and aquifer contamination can occur without contamination of water produced by water wells.
- 3) Few specific reports do not necessarily mean few incidents. In most cases where a homeowner believes the cause of their water contamination is hydraulic fracturing it is because the homeowner has enough awareness and knowledge to know that a nearby well was recently fractured. In many cases where the homeowner has not stated their belief that hydraulic fracturing was the cause, it may be because the homeowner is not familiar with hydraulic fracturing or does not know if the nearby gas well was recently fractured.

I. Specific incidents of concern: Following are descriptions of some specific incidents of which we are aware and that illustrate our concerns.

Texas: In late 2007, three families near **Grandview** noticed changes in their well water just after a natural gas well within a couple of hundred yards of their properties was hydraulically fractured. Within days, five goats and a llama had died. All three families noticed strong sulfur smells in their water, which became unusable. At first their water ran dry, and then the water returned with extremely high pressure, blowing out pipes. Showering caused skin irritation. A letter from the Railroad Commission of Texas acknowledged that testing of well water found toluene and other contaminants.¹

Pennsylvania: In the summer of 2008, contamination of a drinking water well used by two families in **Gibbs Hill** occurred after hydraulic fracturing of a nearby natural gas well. Donna Burger, a nurse, smelled strong fumes and experienced burning in her lungs and sinuses after showering. Her fiancé Clint Yates drank water and felt immediate burning in his mouth. The artesian well that provides the water for these families had run clean and strong for over 100 years. The Pennsylvania Department of Environmental Protection found that pressure in the gas well had exceeded the pressure in the surrounding fresh groundwater system and that there had been unpermitted discharge of hydraulic fracturing fluids.²

On other Pennsylvania cases, the State has not determined the cause. For example, in **Bradford Township**, seven water wells were contaminated earlier this year. The state has prohibited additional drilling of wells in the area at this time, but is allowing fracturing to go forward. There is no information available to the public as to whether any of the wells were fractured immediately before the water contamination.³

At a 2006 meeting of the Pennsylvania Oil and Gas Technical Advisory Board, it was discussed that, in order to save money, gas operators had not allowed wells that have undergone hydraulic fracturing to properly depressurize.⁴ Coincidentally, PADEP reported an increase in gas migrations in McKean, Warren, Forest, Jefferson and Clarion Counties in 2006. In **Dimock Township**, a residential drinking water well exploded without warning near a new gas well in January, 2008. At least three other water wells have been contaminated.⁵ We do not have the current status of the investigation. Gas drilling is blamed for causing natural gas to seep into the **Kushequa** community water well and explode in September 2007.⁶

Ohio: The Payne home in **Bainbridge Township** exploded in December, 2007; fortunately, no one was injured. The Ohio Division of Mineral Resources Management

¹ Letter from Jeff Lauman, TRC, to Todd Thompson, May 16, 2008.

² Pennsylvania Department of Environmental Protection, Notice of Violation, Insp. ID 1727711, Enforcement ID 237069.

³ "Schreiner Oil and Gas Co. deemed responsible for harming at least seven water wells on Hedgehog Lane in Bradford Township, according to DEP," *The Bradford Era*, 5/4/09.

⁴ Pennsylvania Oil and Gas Technical Advisory Board, Meeting Minutes, 9/14/06.

⁵ Wilbur, Tom, "Houses near gas drilling in Dimock hooked to temporary water supply," *Binghamton Press & Sun-Bulletin*, 1/21/2009.

⁶ Lutz, Ted, 'Gas explosions rock Kushequa water well,' *Kane Republican*, 9/19/07.

determined that hydraulic fracturing of a natural gas well with inadequate cementing had not been sufficiently monitored and had allowed natural gas to migrate through fractures in the bedrock into overlying aquifers and eventually into the Payne well. At least 22 other drinking water wells in the area were contaminated with methane.⁷ Groundwater is the primary source of drinking water for 98 percent of the population in this county. One recent news article was headlined: “English Drive homes now worthless, banks say.”

Colorado: The water well of the Amos family, near **Silt**, blew out during hydraulic fracturing of nearby gas wells. Their drinking water turned gray, had strong smells, and bubbled. This case is particularly well known and has been covered widely. The Colorado Oil and Gas Conservation Commission determined that the Amos well was contaminated due to inadequate well structure that resulted in higher than normal well pressures and gas migration into groundwater. Water testing found methane had migrated to the Amos water well.⁸ Two years after this incident, Laura Amos was diagnosed with primary hyperaldosteronism, a rare condition that has been linked in laboratory testing to 2-butoxyethanol -- a chemical that she learned had been used in the hydraulic fracturing near her home.

In July, 2007, the pump house belonging to Ben Bounds in **Huerfano County** exploded. The explosion lifted the pump-house roof off the frame and burned everything inside. Both drilling and hydraulic fracturing were occurring nearby. Investigation of the Bounds’ water well found methane levels high enough to infiltrate their home so that they now have a methane monitor in their house to warn them of a pending explosion and their well must be vented. Other homes in the area also have high methane levels. Community members believe that the methane migrated into faults and fissures that had been previously undisturbed before hydraulic fracturing.⁹

Arkansas: According to a recent news article, at least a dozen residents in the Fayetteville Shale natural-gas drilling area of Arkansas have complained about private well-water contamination related to gas operations. State officials say that water has been tested and no hydraulic fracturing chemicals have been found. It is unknown exactly what was tested for. According to one state official: “...there may have been a disruption of that near-surface water due to mechanical influences of the operation.” But: “there’s no way of proving that because there’s nothing you can measure, other than the circumstantial evidence.”

This article quoted two individuals who specifically mention hydraulic fracturing in connection with their water contamination. One resident, Charlene Parish of **Bee Branch**, said on the day a nearby well was fractured, her whole house shook, her water turned yellow and muddy, and her toilets filled with silt. Former **Pangburn** resident Jeff Graetz said his well went muddy after Southwestern Energy Company fractured

⁷ Ohio Department of Natural Resources, Division of Mineral Resources Management, Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio, September 1, 2008.

⁸ Colorado Oil and Gas Conservation Commission, Administrative Order by Consent, Cause No. 1V, Order No. 1V-298, March 2006.

⁹ McDaniel, Josh, “Boom in gas drilling fuels contamination concerns in Colorado,” *Christian Science Monitor*, 2/5/09.

about 600 feet away from his home in September, 2007. The morning Southwestern started fracturing its gas well, his water became cloudy and contained particles that were “very light and kind of slick” and resembled pieces of leather. “You’d get it by the spoonful, just by sorting the particles out with a coffee filter.”¹⁰

Alabama: The McMillian case is the well-known case that was the basis for the LEAF decision. The McMillian water well in **Northport** became contaminated the day after hydraulic fracturing of a well less than 800 feet from their home. Their drinking water turned gray, bubbled, contained black oily globs, and had strong odors. The water appeared to clear, but again became discolored with strong fumes after another nearby well was fractured later the same week. Testing confirmed the presence of methane gas in the water well, indicating migration between the gas well and the water well. The Alabama Oil & Gas Board never tested the McMillian water for chemical additives in hydraulic fracturing fluids and stated it did not have a complete list of such chemicals. EPA testing did not begin until more than 9 months later, and did not account for seasonal hydrological conditions.¹¹

The Hocutt family’s water well in **Lake View** became contaminated in June, 1989 with brown, slimy, petroleum smelling fluid that was similar to the discharged hydraulic fracturing fluid that traveled downhill from the USX-Amoco methane well near their house (reportedly killing all plant and animal life in its path). Water from a landfill containing municipal and industrial wastes reportedly was used in the fracturing fluid. USX-Amoco closed the well and bulldozed the site in 1991. Ms. Hocutt and her husband both experienced a variety of diseases including cancers of unknown etiology. At least eight more neighbors also have some form of cancer of unknown etiology. EPA Region IV staff collected two grab samples from the well and *targeted* contaminants were not detected.¹² In **Adger**, Francis Herring complained of an oily smell in her drinking water in 1989 after hydraulic fracturing of a nearby coalbed methane well.¹³

Virginia: In **Wise County**, a car wash business located near a coalbed methane well hydraulic fracturing project was forced to close when its well water became too contaminated to operate.¹⁴ In **Buchanan County**, the Buchanan Citizens Action Group reported there were over 100 documented complaints of adverse effects of hydraulic fracturing of coalbed methane wells.¹⁵ In **Dickenson County**, the Dickenson County

¹⁰ Stevens, Laura, “Dirty well water raises stink near drilling sites; Residents cite gas firm for poor quality,” *Arkansas Democrat-Gazette*, 7/5/09.

¹¹ Petition for Promulgation of Rule Withdrawing Approval of Alabama’s Underground Injection Control Program, Submitted to U.S. Environmental Protection Agency by Legal Environmental Assistance Foundation, May 3, 1994.

¹² Comments submitted to EPA Water Docket W-01-09 in response to in Response to 7/30/01 Fed. Reg. Notice Requesting Information Of Ground Water Contamination Incidents Believed To Be Due To Hydraulic Fracturing Of Coalbed Methane Wells. EPA conducted extractable and purgeable organics analyses that did not assess all hydraulic fracturing fluid components.

¹³ Ibid. Also, November 13, 1990, *The Tuscaloosa News*, article submitted to EPA water docket.

¹⁴ Ibid.

¹⁵ Public comments submitted by Sheila McClanahan on behalf of the Buchanan Citizens Action Group to EPA for the August 24, 2000 public hearing about EPA’s proposed study of hydraulic fracturing of coalbed methane wells as well as telephone conversations with other concerned citizens from Buchanan and Dickenson Counties.

Citizens Committee reported ground water quality deteriorated throughout the county as a result of the large number of coalbed methane well hydraulic fracturing events.¹⁶

Wyoming: In the Pinedale Anticline and Jonah natural gas fields near **Pinedale**, Wyoming, 89 industrial water wells and one livestock well have been contaminated with hydrocarbons; 15 have had levels of carcinogenic benzene above federal health standards, including one that is 1500 times the level considered safe for human consumption. This well, along with at least twelve others, have been plugged by the operators, preventing any further monitoring and tracking of pollutants.¹⁷

EPA is already investigating the **Pavillion** water contamination, so we won't go into detail here.

General comments on fracturing unpredictability: A recent article in the *Durango Herald* stated that Bill Barrett Corporation "...has had troubles with its frac jobs diverting into salt formations. When that happens, saltwater flows up along with the gas."¹⁸

John S. Lowe, Professor of Energy Law at Southern Methodist University: "You may plan a fracture that will go 1,000 feet, and it might go 2,000 feet or 400 feet,"¹⁹

John Holden, energy attorney: "How do you prove any fracturing was correct or incorrect in an area that is not precise to begin with?.....Either side has to prove what's going down below, and that's hard for both sides."²⁰

EPA report: The 2004 EPA report lists incidents around the country, including:

- 1) Two well owners from New Mexico claimed that the quality of their water was affected by hydraulic fracturing.²¹
- 2) A La Plata County, Colorado official reported that well owners noticed problems with their well water approximately 2 weeks after nearby fracturing events.²²
- 3) Virginians reported private well and spring water contamination evidenced by oily films, soaps, iron and sulfur, black sediments, murky water, methane gas, diesel odors, and rashes from showering.²³

¹⁶ Comments submitted to EPA Water Docket W-01-09 in response to in Response to 7/30/01 Fed. Reg. Notice Requesting Information Of Ground Water Contamination Incidents Believed To Be Due To Hydraulic Fracturing Of Coalbed Methane Wells.

¹⁷ Letter from U.S. Environmental Protection Agency Region 8 to BLM, February 14, 2008.

¹⁸ Hanel, Joe, "Shale throws industry, Colo. in new terrain; Companies try to keep up with gas technology," *Durango Herald*, 7/12/09.

¹⁹ Tronche, John-Laurent, "Dispute has industry, mineral owners nervous," *Fort Worth Business Press*, 7/7/08.

²⁰ *Ibid.*

²¹ U.S. Environmental Protection Agency, "Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs," June 2004.

²² *Ibid.*

²³ *Ibid.*

II. State regulations and enforcement

EPA should review the standards of state regulations relative to the technical knowledge about protecting aquifers. It should also review the responsiveness to complaints, enforcement of existing standards, and the mechanisms in place to reach satisfactory resolution of citizen complaints and problems that do occur. A common theme that carries across states and incidents when speaking to local residents is that many residents feel that complaints are not addressed or are not addressed adequately and have lost confidence in state regulators.

State regulations

State regulations for hydraulic fracturing activities vary widely. The recent Ground Water Protection Council report on “State Oil and Natural Gas Regulations Designed to Protect Water Resources” included a number of relevant findings,²⁴ with a few excerpted below:

- Of 27 states surveyed, only 14 have the authority to deny a permit for reasons other than the application contains insufficient information to make a technical determination;
- Seven percent of the 27 states reviewed do not require surface casing to be set through the deepest ground water zone;
- 22 percent of the reviewed states require neither a cement setup/waiting period nor a cement integrity test as part of the cementation process.
- While the report states that “...the quality of the initial cement job is the most critical factor in the prevention of fluid movement from deeper zones into ground water resources,” it also states that only “a few” states require an additional verification method using geophysical logs such as Cement Bond Logs (CBL) and Variable Density Logs (VDL).

A recent paper from the Hastings College of the Law, “Selected Topics in State and Local Regulation of Oil and Gas Exploration and Production,” states that when it comes to rules for drilling, casing and protection of groundwater there is a “spectrum of regulation.”²⁵

State complaint response and enforcement

- Regarding the December, 2007 explosion in Bainbridge Township, Ohio, the State did not issue an order to install new water lines to affected homes until April of 2009. The operator in this case has not been fined, and the agency continues to issue drilling permits to this operator --Ohio Valley Energy--right

²⁴ Ground Water Protection Council, “State Oil and Natural Gas Regulations Designed to Protect Water Resources,” May, 2009.

²⁵ “Selected Topics in State and Local Regulation of Oil and Gas Exploration and Production,” available at: <http://www.uchastings.edu/centers/public-law/oil-gas.html>.

in the middle of communities. Homes still have dangerously high gas levels inside.

- In the Colorado case of Laura Amos, the COGCC only tested the water for hydraulic fracturing carrier fluids, and not for chemicals added to the carrier fluids. The carrier fluid of the hydraulic fracturing fluid was not detected in the well water. It is COGCC's official position that if carrier fluids are not found in the water, then it would be impossible for chemical additives to have infiltrated the water. Hydrologists have told us that this is not true.
- In the 2008 Gibbs Hill, Pennsylvania case, the State has not yet issued any final order or enforcement action.
- In the case in Grandview, Texas, residents had to get their water tested by an independent lab. The State acknowledged that toluene was found in a drinking water well by this lab, although the State found that the level of toluene was low enough so that there was no violation of state rules.
- In the Arkansas cases, state agencies declared the water "drinkable." As mentioned above, a state official stated: "...there may have been a disruption of that near-surface water due to mechanical influences of the operation." But: "there's no way of proving that because there's nothing you can measure, other than the circumstantial evidence."
- In the North Fork Ranch community of Colorado, a COGCC environmental specialist alerted the homeowners association to rapidly elevating methane levels in several monitor wells on the ranch in February, 2009. One monitor well also tested for benzene. The homeowners association was told to inform landowners to cease drinking or bathing in their water until a determination could be made. The COGCC staff member committed to provide more information and to file a Notice of Alleged Violation against the operator. Several water wells were tested, found to be not yet impacted, and the community has heard no more. They have written letters to the COGCC asking for information; they don't know whether it is safe to drink their water or not.
- In Bradford Township, Pennsylvania, where seven water wells were contaminated earlier this year, the state has prohibited additional drilling of wells in the area at this time but is allowing fracturing to continue. On a positive note, the Pennsylvania DEP recently issued a cease and desist order to U.S. Energy Development Corporation, thereby shutting it down in the state--after 302 violations over two years.
- According to the 2004 EPA report, in Virginia: "Most of the residents said that their complaints to the state usually resulted in investigations without resolution."²⁶
- In late May, 2008, Ned Prather of Debeque, Colorado went to the hospital with throat problems after he drank water from his faucet. He filed a complaint with the COGCC on June 3, 2008. Water samples from a spring, faucet and pond at Prather's cabin showed benzene levels that exceeded the state's standards. Notices of Alleged Violation were issued but, to date, over a year later, there has been no resolution to this complaint.

²⁶ U.S. EPA, "Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs," June, 2004, Page 6-14.

- In the Buchanan County, Virginia case, the Buchanan Citizens Action Group claims that over 100 documented complaints of adverse effects of hydraulic fracturing of coalbed methane wells were received by the state but were intentionally misclassified and filed as impacts of long-wall coal mining.
- At a public hearing, the director of the Alabama Oil & Gas Board threatened residents who have complained about contamination of their water wells by hydraulic fracturing of coalbed methane wells with liability for waste if their water wells are generating methane gas.²⁷

III. Technical investigation

The original design for the EPA study on hydraulic fracturing of coalbed methane wells envisioned the potential for second and third phases. Only Phase I was completed. Phase II was intended to include site investigations of proposed hydraulic fracturing processes (physical or chemical mechanisms) and an estimate of risk. Phase III would have consisted of an evaluation of existing regulations. We support further technical investigation of hydraulic fracturing, not limited to coalbed methane wells. We also do not think a study needs to be limited to activities that would be covered by the Safe Drinking Water Act. A study should consider the full environmental impacts of hydraulic fracturing, including the storage and disposal of hydraulic fracturing fluids, the use and contents of open air pits, and all potential pathways for environmental impact.

We suggest the following initial parameters for a study:

- monitoring of actual fracturing activities, including geological and hydrological monitoring;
- follow-up evaluation of water quality;
- evaluation of the availability, current usage, and effectiveness of non-toxic drilling and fracturing fluids;
- all technical evaluation conducted by independent experts with an independent, unbiased, non-conflicted review committee, including experts with geological, hydrological, toxicology, and health expertise;
- an evaluation of ways to strengthen the regulatory framework for hydraulic fracturing;
- A specific deadline for study completion.

cc: Arvin Ganesan

²⁷ January 2002 personal correspondence with David Ludder, General Counsel, Legal Environmental Assistance Foundation and lead attorney for LEAF v. EPA, No. 00-10381, 2001 U.S. App. LEXIS 27066 (11th Cir., Dec., 21, 2001).